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ELECTRICITY.—*Quantitative experiments with the audion.* L. W. AUSTIN, U. S. Naval Radiotelegraphic Laboratory.

The extent to which vacuum tube detectors of electrical waves have come into general use both for damped and undamped oscillations has made it desirable to determine the law of response of these instruments, especially as they are often used with shunted telephones for making estimates of the strength of received signals in radiotelegraphy.

The form of vacuum detector chosen for investigation was the DeForest three-electrode audion.[1]

As is well known the audion can be used either as an ordinary detector (old audion connection) with the secondary receiving circuit connected to the hot filament and the intermediate electrode (grid), or by connecting to the grid and cold plate (ultraudion connection) local oscillations may be set up in the receiver so that signals may be received by the beat method.

For determining the laws relating to the strength of the received waves and the response of the detectors, the circuit containing the audion was excited by a wave meter in which oscillations of varying strength were produced either by an oscillating audion for undamped or by a buzzer for damped excitation.

As it is impossible to use a galvanometer directly in the telephone circuit of the audion on account of the continuous current flowing through it from the dry battery, the following arrange-

[1] For description, see Bulletin Bureau of Standards, 6: 540. Reprint 140, 1911.

ment of apparatus was employed: The primary of an iron core telephone transformer was placed in series with the telephones and to its secondary a silicon detector in series with a sensitive galvanometer was connected. The changes in current strength which affect the telephones produce similar effects in the telephone transformer and give rise to alternating currents in the secondary which in turn are rectified in the silicon detector and are thus made to affect the galvanometer. The galvanometer deflections have been shown to be proportional to the square of the alternating currents in the detector[2] and therefore to the square of the telephone pulses in the main circuit. When the audion was made to produce local oscillations these were found to affect the detector slightly, but their influence was entirely eliminated by placing a condenser of 0.1μf across the detector.

The strength of the high frequency oscillations which were sent out from the sending wave meter was measured by means of a thermoelement connected in the wave meter circuit.

TABLE I

OLD AUDION

DAMPED EXCITATION

I_1^2	I_2^2	$\frac{I_1^2}{I_2}$
20	2	14.1
30	4	15.0
50	13	13.9
75	28	14.2
107	57	14.2
121	70	14.5
154	107	14.9
173	145	14.4

The first experiment was intended to determine the law of response of the circuit in old audion connection, the sending wave meter being excited by a buzzer. The results are shown in Table I. Here I_1^2 represents the readings of the thermo-

[2] Bulletin Bureau of Standards, 6: 530. 1911.

element galvanometer in the sending circuit and I_2^2 the readings of the detector galvanometer in the telephone transformer. I_1 is proportional to the high frequency sending currents and therefore to the high frequency currents received; I_2 is proportional to the value of the current pulses in the receiving telephone circuit. Column three, Table I shows that the telephone pulses (response) are proportional to the square of the high frequency currents received. An experiment similar to the above except that the receiving circuit had the ultraudion connection, but so adjusted that no local oscillations were produced, shows that the same law holds as in the case of the old audion connection.

TABLE II

OSCILLATING ULTRAUDION

DAMPED EXCITATION

I_1^2	I_2^2	$\frac{I_1}{I_2}$
11	9	1.11
20	19	1.02
33	29	1.06
52	46	1.06
71	64	1.05
90	84	1.03

TABLE III

OSCILLATING ULTRAUDION

UNDAMPED EXCITATION

I_1^2	I_2^2	$\frac{I_1}{I_2}$
1	2	0.71
3	4	0.87
5	8	0.79
7	11	0.80
9	16	0.75

Tables II and III show the results with the audion in ultraudion connection and oscillating. In Table II the sending waves are damped as in Table I, while in Table III the sending waves are undamped, the sending wave meter being excited by

an oscillating audion. Here the note in the receiving telephone is produced by the beats between the local and incoming oscillations, being rough from the damped oscillations but clear and musical from the undamped.

Column three in each of the last two tables shows that the response in the case of the local oscillations is proportional to the received high frequency current and not to its square as was the case in the non-oscillating audion. The value of the ratios in the third columns shows that the response of the receiving telephone is greater for undamped oscillations than for damped, other things being equal, in the ratio 1.4 to 1. But assuming equal decrements in the sending and receiving circuits, which is probably at least approximately correct, this represents equal sensitiveness, since in the case of undamped waves $I = \frac{E}{R}$ and in the case of damped $I = \frac{E}{R\sqrt{1 + \frac{\delta_1}{\delta_2}}}$ where $\frac{\delta_1}{\delta_2}$ represents the ratio of decrements in the two circuits.

In addition to the experiments with the detector and galvanometer, determinations have also been made of the relative sensibility of the old audion and the oscillating ultraudion connections. For this the shunted telephone method was used with spark excitation, either distant signals or from the buzzer. It was found that for unit audibility with the old audion connection the oscillating ultraudion gave from three hundred to one thousand audibility, but as the law of response is different in the two cases the ratio will of course decrease as the signals grow stronger. With the non-oscillating ultraudion the signals are from twenty to forty times as strong as with the old audion. This ratio becomes greater if the ultraudion is brought nearer to the oscillating condition.

The experiments show that the atmospheric disturbances are but little louder in general with the oscillating audion than with the old audion; the sounds are more continuous in the former, however.

PALEOBOTANY.—*Notes on two conifers from the Pleistocene Rancho La Brea asphalt deposits, near Los Angeles, California.*[1] F. H. KNOWLTON, Geological Survey.

The famous asphalt deposits or so-called "tar-pits" of the Rancho La Brea, near Los Angeles, California, are now well and widely known from the vast numbers of animal remains that have been exhumed from them. From the many hundreds of skulls and tens of thousands of skeletal bones that have been brought to light, it is said that more than fifty species of birds, and nearly or quite as many kinds of mammals, have been identified. Considering the marvelous degree of perfection with which these animal remains have been preserved, it has been—at least to the writer—a matter of speculation as to why it was not equally fitted to preserve such hard parts of plants as seeds, fruits, cones, wood, etc., as must have chanced to fall into it. Be this as it may, plant remains, at least so far as recorded observations go, appear to be exceedingly rare, and it is, therefore, with especial pleasure that I am able to record the discovery of two perfectly preserved coniferous cones that were recently sent me for identification.

These cones were received, through Mr. H. W. Henshaw of the Biological Survey, from Mr. Frank S. Daggett, Director of the Museum of History, Science, and Arts of Los Angeles, in which institution they are now deposited. They are said to be the only cones thus far discovered in these deposits, which, if true, seems a very remarkable condition. They are, of course, thoroughly impregnated with the asphaltum and are black in color. They have suffered no distortion and are in practically perfect condition. The species represented are: *Pinus attenuata* Lemmon, *Cupressus macrocarpa* Hartweg.

The knobcone pine, according to Sudworth's "Forest Trees of the Pacific Slope," ranges throughout the Coast Mountains of southern Oregon and of California, and also in the southern Cascades of Oregon and northern California Sierras, while the Monterey cypress is confined to a few miles of the central Cali-

[1] Published with the permission of the Director of the U. S. Geological Survey.

fornia coast on the peninsula between Monterey Bay and Carmel Bay. This shows that the knobcone pine is, at least in part, living in the same general area it occupied in Pleistocene time, whereas the cypress has retreated for some hundreds of miles up the coast, where apparently it has made its last stand.

It is perhaps presumptuous with the data available to venture to draw any conclusion as to the climatic and other conditions that obtained when these cones were entombed in the Rancho La Brea deposits, but such as it is it may be presented. According to Sudworth the knobcone pine now occurs usually on dry, exposed, steep southern slopes, but often in deep gulches and protected ravines, growing on poor, dry, rocky, or gravelly and sandy soils. It endures seasonal changes of temperature from zero to 95° F., with occasional heavy snows and an annual rain fall up to 45 inches.

The Monterey cypress in its natural state appears to require quite different conditions. It grows on rocky sea cliffs in clay loam soil, under a mild equable temperature, never at freezing point and rarely above 90° F. The annual rain fall is about 17 inches, but the moist sea winds keep the air humid for the greater part of the year. As it is often planted in other parts of California for wind-breaks, it has been found that it will not only thrive in fresh soils away from the influence of the sea, but is capable of withstanding a greater range in temperature than that of its native range. If planted in dry soils where the temperature falls below freezing, it will grow well and mature its wood before frost.

Inasmuch as the trees themselves, judging from these two cones, appear to have changed very little between the Pleistocene and the present time, it at least suggests that their climatic requirements have likewise suffered little change.

ETHNOBOTANY.—*Quichua names of sweet potatoes.* O. F. Cook, Bureau of Plant Industry.

Quichua was the language of the Incas at the time of the Spanish conquest of Peru, and is still spoken by a large native population. The ancient center of the Quichuas is in the region about Cuzco on the eastern slope of the Andes, from an altitude of

over 14,000 feet at the Pass of La Raya, down to Santa Ana, at an altitude of 3000 feet. The lower valley of the Urubamba river was visited by the writer in May, June, and July, 1915, as a member of the Yale Peruvian Expedition conducted by Prof. Hiram Bingham, of Yale University, in cooperation with the National Geographic Society and the United States Department of Agriculture.

At 6000 feet and below, the sweet potato (*Ipomoea batatas*) is one of the principal root-crops. At Santa Ana it appears to be somewhat less important than *rumu* (Manihot) or *uncucha* (Xanthosoma), but much more important than *achira* (Canna). Two classes of sweet potatoes are recognized under separate names, *apichu* for the sweet varieties and *cumara* for the starchy. A similar distinction is often made in the United States between "sweets" and "yams." The Quichua language seems to have no inclusive term that can be applied to all kinds of sweet potatoes. For this purpose Spanish-speaking Quichuas use the word "*camote*."

Both cumaras and apichus are represented by numerous varieties differing in shape and color of roots and foliage. At San Miguel, in the valley under Machu Picchu, with an altitude of 6000 feet, three varieties of cumaras were noted: *yuracjcumara* (white), *pucacumara* (red), and *compillicjlla*, the last a very short turnip-shaped purple root. Of apichus there were also three varieties, *yuracjapichu*, *pucaapichu*, and *azulapichu* (blue, a combination of Spanish and Quichua). Other names, learned at Santa Ana, are *oqquechuto*, *cusicumara*, and *pucacusicumara*, the last mentioned said to mean "red-long-cumara." Another with deep purple flesh like a beet, that stains the tongue, is called *incampamaccasccan*. At Lima the Quichua names are not recognized, only *camote* being used. Two varieties grown between Lima and Callao are called *supano* and *luriniano*, the former with leaves very deeply cut, the latter with nearly entire leaves. Supe and Lurin are places on the coast not far from Lima.

Wild sweet potatoes are said to be of common occurrence in the valleys of the interior. At San Miguel a plant identified by the Indians as *cusiapichu* was found growing spontaneously

in a place not recently cultivated. At Santa Ana three distinct kinds, to judge from the foliage, were found as common weeds in cultivated land. But to certify that any plant is a genuine native species seems out of the question in a region where all of the land has probably been cleared many times and cultivated intermittently for centuries. On the other hand, there is no reason to deny that the sweet potato may have been domesticated in the Peruvian region, as many other plants appear to have been.

The words *apichu* and *cumara* have been recorded before, but without indications of their concurrent use and distinct applications among the Quichuas. Markham's Quichua *Vocabulary* gives *apichu* as the name of the sweet potato, but overlooks *cumara* altogether. Reference might also be made to Holguin's *Arte y Diccionario* without finding *cumara*, since the word does not appear in its alphabetic position, but under *apichu* we find: "Apichu, cumar, *nom.* Camote." Martius's *Ethnographie* has neither *apichu* nor *cumara*, but gives *camote* as the Quichua name, with a derivation from the Mexican *camotli*. Cobo, whose *Historia* was written in Peru less than seventy years after the conquest (though not published till 1890), recorded *apichu* as the Quichua name, *tutuca* as the Aymara name, and *camote* as the name used by the Spaniards of Peru, borrowed from the language of Mexico. Cobo appears to have visited the interior of Bolivia, but not the interior of Peru.

No reason is apparent for questioning the status of *apichu* and *cumara* as genuine Quichua words. Etymologies would be easy to invent. For *apichu* such a combination as *api* (maize pudding) and *pichu* (flesh) or *pichi* (root) would be appropriate, while *cumara* might be related to *ccumu* or *kumu*, meaning crooked or hunch-backed. Other Quichua names analogous to *cumar* or *cumara* are *pallar* (Phasaeolus), *quiñuar* (Buddleia), *quisuar* (Polylepis), *ancara* (gourd), *sara* (Zea), *tara* (*Caesalpinia tinctoria*), and *achira* (Canna).

The sweet potato was not known to Europeans before the discovery of America. The first name that the Spaniards learned and carried back to Spain was *batata*, the original of our word potato, but the Mexican name *camote* is now more widely

known in Spanish America. Many names in local languages have probably been lost, but some have been placed on record. Martius collected the following series from native tribes of Brazil: *coutarouti, coundi, gnunana, hetich, ictig, imazaka, jetica, joto, mapas* (?), *maporu, mapuey, mouka, napi, orairai, quaiu, tsa,* and *zamaygua.*

In the Kekchi language of eastern Guatemala, a member of the Maya family, the sweet potato bears the name *is.* The Kekchis do not raise many sweet potatoes, this crop being distinctly less important than *osh* (Xanthosoma) or *piyak* (Dioscorea), yet sweet potatoes often grow as weeds in cultivated lands. The potato (*Solanum tuberosum*) is called by the Kekchis *kashlanis,* meaning "foreign sweet potato."

Several of the early Spanish historians of the West Indies recorded the name *age* or *aje,* but whether this belonged properly to the sweet potato or to some other root-crop has been uncertain. Some of the accounts evidently refer to Manihot, but Gray and Trumbull settled upon Dioscorea as the correct application.[1] Gomez de la Maza claims both *age* and *boniato* as indigenous Cuban names of sweet potatoes. More than a score of Cuban varieties are listed, mostly with names derived from native languages of the Island. *Boniato* is the name in regular use in Cuba, *batata* being scarcely known.[2] *Batata* is used in Puerto Rico, Venezuela, and Panama; but two indigenous names, *araba* and *deki,* are reported by Pittier from primitive tribes living on the Atlantic slope of Costa Rica.[3]

Among all these names of sweet potatoes in other parts of America there appears to be no definite resemblance to either of the Quichua words, *apichu* and *cumara.* Perhaps the nearest approach to similarity is between *cumara* and the Mexican *camote* or *camotli.* Yet the number and diversity of the native names are not without significance as indications of the American

[1] Gray A., and Trumbull, J. H. Review of de Candolle's Origin of Cultivated Plants; with annotations upon certain American species. American Journal of Science, Third Series, 25: 250. 1883.

[2] Gomez de la Maza, M. Diccionario Botanico de los Nombres Vulgares Cubanos y Puerto-Riqueños. 1889.

[3] Pittier, H. Plantas Usuales de Costa Rica, 165. 1908.

origin of the sweet potato or, at least, of its wide distribution in prehistoric times.

The general interest of the Quichua names lies in the fact that *cumara* or *kumara* is also the name of the sweet potato in the Polynesian Islands. This was first pointed out by Seemann, a botanist who had visited the Pacific Islands and the west coast of South America about fifty years ago. Seemann's observation appeared as a brief editorial note in connection with a statement by the ethnologist Crawfurd, to the effect that no communication could have taken place between the American continent and the Pacific Islands.[4]

The presence of the Quichua name in Ecuador is readily understood, the native kingdom of Quito having been conquered and occupied by the Incas. Some of the early Spanish historians of Peru recorded Inca traditions of voyages to islands in the Pacific, but such a possibility of communication between the American continent and the Pacific Islands has not seemed worthy of serious consideration. Nevertheless, cultivated plants of American origin appear to have crossed the Pacific before the arrival of Europeans. Among these trans-Pacific plants are the coconut palm, the bottle-gourd, and the sweet potato. Coconuts and gourds may be supposed to have floated to the Islands and established themselves without human assistance, but the sweet potato and its name could hardly be conveyed in this manner. Nor is it to be taken as a mere coincidence that a Quichua name not shared with other American languages should be associated with the same crop in the Pacific Islands.

[4] Crawfurd, John. On the migrations of cultivated plants in reference to ethnology. Seemann's Journal of Botany, **4**: 328. 1866.

"The Sweet Potato, or tuber-yielding Convolvulus, appears to be a native of many parts of the tropical Old and New World. Some have alleged that it was first made an object of cultivation by the native Americans, but when the South Sea Islands, which had assuredly no communication with the American people, were discovered, the sweet potato was found to be in cultivation, and known by a native name throughout, the word being essentially the same, and a native one varying only in pronunciation, as *kumava*, *humaa*, and *gumala* abbreviated *mala*."

Seemann's comment on the above statement was as follows: "[*Kumara* or *umara*, of the South-Sea Islanders, is identical with *cumar*, the Quichua name for sweet potato in the highlands of Ecuador.—Ed.]

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

CHEMISTRY.—*Some qualitative tests for gum arabic and its quantitative determination.* C. E. WATERS and J. B. TUTTLE. Bureau of Standards Technologic Paper No. 67. Pp. 15. 1916.

A study of many of the published tests for the gum, as well as a search for others than the few that proved to be reliable. It was found that basic lead acetate gives the most characteristic reaction, while mixtures of copper sulphate and sodium hydroxide, and of neutral ferric chloride and alcohol are of value as confirmatory tests. Dextrin and gum ghatti were subjected to the same tests.

A summary of the more important methods that have been proposed for the quantitative estimation of gum arabic is next given, followed by a description of the steps that led the authors to the use of alcoholic copper acetate-ammonia solution for this determination. C. E. W.

CHEMISTRY.—*The determination of barium carbonate and barium sulphate in vulcanized rubber goods.* JOHN B. TUTTLE. Bureau of Standards Technologic Paper No. 64. Pp. 5. 1916.

Specifications for purchasing rubber goods frequently permit the use of barytes (barium sulphate) as a mineral filler without having the sulphur which it contains count as part of the specified total sulphur. In such cases the barium sulphate must be determined in order to properly correct the total sulphur.

When barium sulphate only is used, the amount present is readily ascertained by determining the total amount of barium present. If barium carbonate is used, it is necessary to separate the two salts. By means of tests made on compounds of known composition prepared at the Bureau of Standards, a method has been devised which permits the quantitative determination of barium carbonate in the

presence of either lead sulphate or barium sulphate, the two sulphates most commonly used in rubber goods. The accuracy of the determination is satisfactory for all practical purposes. J. B. T.

GEOLOGY.—*The stratigraphy of the Montana group.* C. F. BOWEN. U. S. Geological Survey Professional Paper No. 90, pp. 95–153. 1915.

Because of differences of opinion which have arisen regarding the age and stratigraphic position of the Judith River formation, a study of the stratigraphy of the Montana group was undertaken.

It is shown that the Judith River formation has been traced continuously from areas where its position beneath the Bearpaw shale is undisputed into the western part of the type area (namely, at the mouth of Judith River) and has been found to be identical with the Judith River at that locality.

The paleontologic evidence shows: (1) that the argument that the Judith River formation overlies the Fox Hills is unfounded; (2) that the flora of the Judith River formation is of Montana age; (3) that the invertebrates of the Judith River formation are more closely allied to the Belly River than to the Lance; (4) that if the Judith River is to be made the equivalent of the Lance on the basis of the similarity of the vertebrate fauna, the Belly River must on the same evidence also be made the equivalent of the Lance formation; (5) that the Ceratopsidae, which form so important an element of the Lance fauna, are generically and specifically unlike the representatives of that family in the Belly River and Judith River faunas. The palaeontologic evidences therefore indicating a closer relationship between the Belly River and Judith River than between either of these formations and the Lance are in accord with the stratigraphic evidence, which shows conclusively that both the Judith River and Belly River formations are separated from the Lance by a marine formation which is of undoubted Cretaceous age. R. W. S.

GEOLOGY.—*Erosion intervals in the Eocene of the Mississippi embayment.* E. W. BERRY. U. S. Geological Survey Professional Paper No. 95, pp. 73–82. 1915.

The older Tertiary deposits of the Gulf Coastal Plain, comprising several thousand feet of sands, clays, marls, lignites, and impure limestones, have always been considered as forming an uninterrupted and conformable series, extending from the lower Eocene to the top of the

Oligocene. It is shown in this paper that the sedimentation of Eocene time was interrupted during several intervals, which were of considerable duration in terms of organic evolution. Such intervals occurred between the Midway or basal Eocene deposits and the overlying Wilcox group and between the Wilcox and the Claiborne.

It is concluded that the strand line migrated back and forth over the Mississippi embayment several times during the period represented by the older Tertiary deposits. R. W. S.

GEOLOGY.—*The Willow Creek district, Alaska.* S. R. CAPPS. U. S. Geological Survey Bulletin No. 607. Pp. 86, with maps, sections, and illustrations. 1915.

The geologic formations exposed consist of mica schists, possibly of Paleozoic age; quartz diorites and gneisses, probably Mesozoic; Eocene arkoses, conglomerates, shales, and sandstone, with some interbedded basaltic lava flows; and Quarternary glacial deposits and recent stream gravels. The Tertiary beds are somewhat folded, but have prevailing dips of 20° to 50° to the southward.

Gold quartz veins fill fissures in the quartz diorite, and occur in two predominant sets, one striking northwest, and the other northeast. The prevailing dip is 30° to 50° to the westward. The veins show little surface oxidation and no secondary enrichment and promise to maintain the same characters with depth that they display near the surface.

Some gold placer deposits have been worked, but most of the concentrations of placer gold that must have resulted from the erosion of the gold-bearing quartz veins were swept away and scattered by the vigorous glaciers which occupied the valleys during the height of the Quarternary ice invasion. S. R. C.

GEOLOGY.—*The Ellamar district, Alaska.* S. R. CAPPS and B. L. JOHNSON. U. S. Geological Survey Bulletin No. 605. Pp. 125, with maps, sections, and illustrations. 1915.

The rocks exposed include the Valdez group of interbedded slates and graywackes, possibly of Paleozoic age, and the Orca group, possibly Mesozoic, including in ascending order: (1) fine black slates; (2) slates and graywackes; (3) ellipsoidal lavas and massive diabase flows with some interbedded sediments; (4) conglomerates and sandstones; and (5) another series of slates and graywackes. The dominant structural trend is northwest-southeast, and the beds have prevailing dips to

the northeast. The rocks of the Valdez group overlie those of the Orca group, as the result of a great overthrust fault. In the almost complete absence of fossils the age of the various formations has not been conclusively determined.

The sulphide ore veins of the district, most of which are mined chiefly for their copper content, but one of which is now producing gold ores, occur in zones of fracture and shearing along fault planes. Most of the mines and prospects occur in the greenstones, but the largest mine is in slate and graywacke, stratigraphically beneath the greenstone. The shear zones in many places are particularly well developed in slates and graywackes interbedded with the greenstones, as these sedimentary beds yielded to the deformational stresses more readily than the greenstones themselves. The ores are, in part at least, replacements of the crushed rock, but in the largest mine they are believed to replace calcareous sedimentary beds. The copper in the veins as well as the gold is believed to be genetically connected with granitic intrusives and not derived from the greenstones as has been previously suggested.

S. R. C.

GEOLOGY.—*Rhode Island coal.* GEORGE H. ASHLEY. U. S. Geological Survey Bulletin No. 615. Pp. 62, 5 plates. 1915.

Coal occurs at a number of places near Providence and Newport, Rhode Island. Attempts to use it as fuel began nearly 150 years ago, but in spite of its favorable situation as regards markets and transportation these have not met with success.

The rocks of the Rhode Island coal field have been subjected to intense lateral pressure which folded them in great folds with accompanying crushing, squeezing, and shearing. As in regions of intense pressure and folding the softer rocks tend to yield, flowing away from points of greatest pressure, so the Rhode Island coal has moved under pressure and accumulated as irregular lenses in places of less pressure. The pressure and accompanying heat changed the coal to anthracite containing a high percentage of fixed carbon, and in places to graphite. The graphite is localized where the metamorphism was greatest. In general, the thinner the coal at any point, the larger the percentage of graphite it contains.

Crevices in the coal have locally become filled with quartz or asbestos.

The breaking open and recementing of the coal appears to have let into it more or less of the adjoining shale, so that where the coal is

thin from having been squeezed it is higher in ash. The coal in the same mine therefore may be high in graphite and ash where it is thin, and freer of both ash and graphite in the wider pockets.

The field as a whole appears to have been subjected to large regional differences in pressure and there are corresponding regional differences in the coal.

Rhode Island coal is a high-ash, high-moisture, graphitic anthracite of high specific gravity. R. W. S.

GEOLOGY.—*The Broad Pass region, Alaska.* FRED H. MOFFIT, *with sections on Quarternary deposits, igneous rocks, and glaciation,* by JOSEPH E. POGUE. U. S. Geological Survey Bulletin No. 608. Pp. 80, with maps, section and views. 1915.

The region described lies south of the axis of the Alaska Range and includes part of the headwaters of Susitna, Chulitna, and Nenana rivers. Rocks ranging in age from Devonian to Tertiary are exposed and in addition unconsolidated deposits of glacial, glacio-fluvial, and fluvial origin are present.

The Devonian rocks include limestone, slate, and conglomerate, all of which are folded and otherwise altered. In places the slate and conglomerate have become schistose. Rocks tentatively referred to the Triassic are basaltic lavas apparently overlain by dark-blue and black slates with interstratified arkose and graywacke. Other dark-blue and black slates interbedded with graywacke and conglomerate are tentatively referred to the Jurassic and a complex of sedimentary rocks, chiefly slate and limestone, are considered to be probably Mesozoic. The principal Tertiary rocks are the Cantwell formation (Eocene), a massive conglomerate, locally containing fossiliferous shale beds. It is folded and in its eastern extension takes on a schistose structure.

All the consolidated sediments are cut by intrusives, most of which are granitic or porphyritic and of felsic (acid) character. The youngest intrusives are of Tertiary age.

The Broad Pass region has been profoundly glaciated, as is plainly shown by its topography.

Mining has not been established here. The region, however, is favorable for prospecting. F. H. M.

REFERENCES

Under this heading it is proposed to include, by author, title, and citation, references to all scientific papers published in or emanating from Washington. It is requested that authors coöperate with the editors by submitting titles promptly, following the style used below. These references are not intended to replace the more extended abstracts published elsewhere in this JOURNAL.

MAMMALOGY

ALLEN, G. M. *The water shrew of Nova Scotia.* Proceedings of the Biological Society of Washington, **28:** 15–17. February 12, 1915. (Description of *Neosorex palustris acadicus*, subsp. nov.—N. H.)

BAILEY, V. *Revision of the pocket gophers of the genus Thomomys.* North American Fauna No. 39. Pp. 1–136, *plates 1–8, figs. 1–10.* November 15, 1915. (Monograph of the species and subspecies, with maps of distribution; *Thomomys sheldoni*, from Tepic, is described as new.—N. H.)

DEARBORN, N. *Silver fox farming in eastern North America.* Bulletin of the U. S. Department of Agriculture No. 301. Pp. 1–35, *figs. 1–22.* October 29, 1915. (Complete account of breeding foxes of the genus Vulpes for commercial purposes.—N. H.).

FIGGINS, J. D. *Diagnosis of a new subspecies of marmot from Colorado.* Proceedings of the Biological Society of Washington, **28:** 147–148. September 21, 1915. (Describes *Marmota flaviventer campioni*, from Jackson County, Colorado.—N. H.)

GOLDMAN, E. A. *A new spider monkey from Panama.* Proceedings of the Biological Society of Washington, **28:** 101–102. April 13, 1915. (Description of *Ateles dariensis*, sp. nov.—N. H.)

GOLDMAN, E. A. *Five new rice rats of the genus Oryzomys from Middle America.* Proceedings of the Biological Society of Washington, **28:** 127–130. June 29, 1915. (New forms: *Oryzomys guerrerensis, O. nitidus alleni, O. alfaroi dariensis, O. couesi regillus*, and *O. fulvescens lenis.*—N. H.)

GOLDMAN, E. A. *Five new mammals from Mexico and Arizona.* Proceedings of the Biological Society of Washington, **28:** 133–137. June 29, 1915. (Describes new forms of Potos, Geomys, Neotoma, and Noctilio.—N. H.)

HOLLISTER, N. *The type locality of* Pecari tajacu. Proceedings of the Biological Society of Washington, **28:** 70. March 12, 1915.

HOLLISTER, N. *A new name for the white-tailed jack rabbit.* Proceedings of the Biological Society of Washington, **28:** 70. March 12, 1915. (*Lepus campanius* proposed, to replace *L. campestris*, preoccupied.—N. H.)

HOLLISTER, N. *The systematic name of the Mexican spider monkey.* Proceedings of the Biological Society of Washington, **28:** 142. June 29, 1915. (*Ateles neglectus* Reinhardt, 1872, replaces *A. tricolor* Hollister, 1914.—N. H.)

HOLLISTER, N. *The genera and subgenera of raccoons and their allies.* Proceedings of the U. S. National Museum, **49**: 143-150, *pls. 38, 39.* August 13, 1915. (New genus: Nasuella, for the mountain coati mundi, *Nasua olivacea*, and its related forms.—N. H.)

HOLLISTER, N. *The specific name of the striped muishond of South Africa.* Proceedings of the Biological Society of Washington, **28**: 184. November 29, 1915. (The Cape form of the striped muishond to be known as *Ictonyx striatus*.—N. H.)

HOWELL, A. H. *Revision of the American marmots.* North American Fauna No. 37. Pp. 1-80, *plates 1-15.* April 7, 1915. (History, habits, economic relations, and systematic account of the American woodchucks and marmots. *Marmota monax petrensis*, from British Columbia, and *Marmota flaviventris sierrae*, from California, are described as new.—N. H.)

HOWELL, A. H. *Descriptions of a new genus and seven new races of flying squirrels.* Proceedings of the Biological Society of Washington, **28**: 109-113. May 27, 1915. (The generic name Eoglaucomys is proposed for the Himalayan *Sciuropterus fimbriatus*, and new species and subspecies of American flying squirrels are named.—N. H.)

JACKSON, H. H. T. *A review of the American moles.* North American Fauna No. 38. Pp. 1-100, *plates 1-6, text figs. 1-27.* September 30, 1915.

LANTZ, D. E. *Field mice as farm and orchard pests.* U. S. Department of Agriculture, Farmers' Bulletin No. 670. Pp. 1-10. June 3, 1915. (Describes the habits, geographic distribution, and methods of destroying meadow mice and pine mice, and discusses the value of protecting their natural enemies.—N. H.)

LYON, M. W., JR. *Eureodon as the generic name of the warthogs.* Proceedings of the Biological Society of Washington, **28**: 141. June 29, 1915. (Eureodon Fischer, 1817, replaces Phacochoerus.—N. H.)

LYON, M. W., JR. *Macaca versus Pithecus as the generic name of the macaques.* Proceedings of the Biological Society of Washington, **28**: 179. November 29, 1915. (Macaca to be restored in place of the recently used Pithecus.—N. H.)

MILLER, G. S., JR. *A new squirrel from northeastern China.* Proceedings of the Biological Society of Washington, **28**: 115, 116. May 27, 1915. (Describes *Tamiops vestitus* from 65 miles northeast of Peking.—N. H.)

OSGOOD, W. H. *The name of Azara's agouarachay.* Proceedings of the Biological Society of Washington, **28**: 142-143. June 29, 1915. (Discusses the nomenclature of two South American species of Canis.—N. H.)

OSGOOD, W. H., PREBLE, E. A., and PARKER, G. H. *The fur seals and other life on the Pribilof Islands, Alaska, in 1914.* Bulletin of the Bureau of Fisheries No. 34. Pp. 1-172, *plates 1-18, maps 1-24.* June 19, 1915.

SHUFELDT, R. W. *Comparative study of certain cranial sutures in the primates.* Anatomical Record, **9**: 121-124. January 20, 1915. (Abstract of a more formal paper in preparation.—N. H.)

SHUFELDT, R. W. *On the taxonomy of the Procyonidae.* Science, n. s., **61**: 691, 692. May 2, 1915. (Advance abstract of a memoir containing complete and comparative accounts of the osteology of the various genera of Procyonoidea, which will be published later, with plates.—N. H.)

THOMAS, O. *Determination of* Vesperugo vagans *Dobson from "Bermuda."* Proceedings of the Biological Society of Washington, **28**: 69. March 12, 1915. (*Vesperugo vagans* proves to be identical with *Chalinolobus tuberculatus* of New Zealand, and the locality, "Bermuda," is unquestionably erroneous.—N. H.)

THOMAS, O. *The generic name Connochaetes of Lichtenstein.* Proceedings of the Biological Society of Washington, **28**: 69. March 12, 1915. (*Connochaetes* Lichtenstein, 1814, considered a valid name.—N. H.)

THOMAS, O. *Phacochoerus as the generic name of the warthogs.* Proceedings of the Biological Society of Washington, **28**: 181. November 29, 1915. (*Phacochoerus* Cuvier not to be replaced by *Eureodon* Fischer.—N. H.)

TECHNOLOGY

BUREAU OF STANDARDS. *Standard tables for petroleum oils.* Circular No. 57. Pp. 64. 1916. (For finding the density at a standard temperature when the density at another temperature is known.)

BOUGHTON, E. W. *The detection of resin in drier.* Bureau of Standards Tech. Paper No. 66. Pp. 9. 1916.

ENGINEERING

MARSHALL, R. B. *Profile surveys in Willamette River basin, Oregon.* U. S. Geological Survey Water-Supply Paper 349. Pp. 9. 1914.

MARSHALL, R. B. *Profile surveys in Bear River basin, Idaho.* U. S. Geological Survey Water-Supply Paper 350. Pp. 9. 1914.

MARSHALL, R. B. *Profile surveys in Snoqualmine, Sultan, and Skykomish rivers, Washington.* U. S. Geological Survey Water-Supply Paper 366. Pp. 7. 1914.

MARSHALL, R. B. *Profile surveys in Missouri River from Great Falls to Three Forks, Montana.* U. S. Geological Survey Water-Supply Paper 367. Pp. 8. 1914.

MARSHALL, R. B. *Profile surveys in Wenatchee River basin, Washington.* U. S. Geological Survey Water-Supply Paper 368. Pp. 7. 1914.

MARSHALL, R. B. *Profile surveys in Chelan and Methow River basins, Washington.* U. S. Geological Survey Water-Supply Paper 376. Pp. 8, 5 profiles. 1915.

MARSHALL, R. B. *Profile surveys in 1914 in Umpqua River basin, Oregon.* U. S. Geological Survey Water-Supply Paper 379. 23 profiles. 1915.

PIERCE, C. H., and LARRISON, G. K. *Water resources of Hawaii, 1912.* U. S. Geological Survey Water-Supply Paper 336. Pp. 392. 1914.

STEVENS, GUY C., and HALL, W. E. *Surface water supply of South Atlantic and eastern Gulf of Mexico basins, 1913.* U. S. Geological Survey Water-Supply Paper 352. Pp. 84. 1915.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

BOTANICAL SOCIETY OF WASHINGTON

The 106th regular meeting of the Botanical Society of Washington was held at the Cosmos Club, Tuesday, October 5, 1915, at 8 p.m. Thirty members and two guests were present. The following scientific program was given:

Some recent investigations in sugar-beet breeding (lantern slides): F. J. PRITCHARD. The speaker presented a large number of tables and figures based upon 10 years' experiments in sugar-beet breeding from which the following conclusions were drawn: Differences in the size, total sugar content, and percentage of sugar of individual beet roots show no evidence of inheritance. There is no correlation between percentage or quantity of sugar of roots of ordinary sizes and their yield of seed nor between their yield of seed and the average percentage of sugar in their progeny. Fluctuations in percentage and yield of sugar of beet families planted in progeny rows in alternation with check rows greatly exceed their real differences. The discontinuance of selection for one generation caused no deterioration but some apparent gain in percentage of sugar. No improvement was obtained in yield or percentage of sugar from continuous selection; both the good and the poor families transmitted average qualities. Fluctuations in percentage and yield of sugar are caused chiefly by irregularities of the soil; the nutritive conditions which favor the production of a large root cause a large tonnage of beets but a low percentage of sugar; even with a uniform stand certain rows and certain parts of the field produce a relatively small root and consequently a high percentage of sugar, while neighboring areas produce a large root and a low percentage of sugar. As the fluctuations in percentage and yield of sugar are large they obscure real differences between varieties or families, but real differences may be distinguished by planting each variety or family a large number of times.

Notes on plant-parasitic nematodes (lantern slides): L. P. BYARS. After a few introductory remarks concerning the general characteristics of the three groups of nematodes—the free living, animal-parasitic, and plant-parasitic—the speaker indicated some of the more important anatomical and life-history features of species belonging to the last group. Emphasis was laid on the economic importance of and present distribution of *Tylenchus dipsaci*, the bulb and stem-infesting nematode; *Tylenchus tritici*, a nematode living in wheat kernels; *Aphelenchus armerodis*, the violet bud organism; and *Heterodera radicicola*, the gall-forming nematode, all of which are parasites introduced into this country. Illustrations and drawings were used to show the speaker's

method of growing *Heterodera radicicola* in pure culture and to indicate the effect of this parasite on its host.

The first Washington Botanical Society: P. L. RICKER. While collecting material for the bibliography and biography in the forthcoming Flora of Washington the speaker first learned[1] of the existence of a Washington Botanical Society organized on March 13, 1817 with thirteen charter members: JOHN BOYLE, W. A. BRADLEY, Dr. JOHN A. BRERETON, SAMUEL ELLIOT, JR., WILLIAM ELLIOT, J. W. HAND, Dr. HENRY HUNTT, Maj. JAMES KEARNEY, Rev. Dr. JAMES LAURIE, Dr. ALEXANDER MCWILLIAMS, J. M. MOORE, JOHN UNDERWOOD, and GEORGE WATTERSON. Subsequently six additional members were elected and three honorary members: Dr. JACOB BIGELOW, Dr. WILLIAM DARLINGTON, and Dr. WILLIAM P. C. BARTON. Meetings of the society were held until March 27, 1826, when the society adjourned *sine die*. It was ordered that the library of the society be deposited in the Washington Library. The herbarium was placed under the care of Dr. McWilliams, but its subsequent disposition has not been learned. The records of the society eventually found their way into a local second hand book store and were presented to the late LESTER F. WARD in 1883, remaining in his possession until his death, when his library was given to Brown University. After correspondence with the librarian of Brown University, formal request was made to the Trustees of that institution by the Secretary of this Society for the return of the records to Washington, which request was granted. The proceedings of the meetings for the first few years show considerable progress in the study of the local flora and offer many interesting historical data.

The 15th annual meeting of the Botanical Society of Washington was held at the Department of Agriculture, Tuesday, October 19, 1915 at 1.30 p.m., with twenty-four members present. The report of the Executive Committee showed the following facts concerning the activities of the society for the preceding year. Average attendance of 73 members and guests. Seven members were lost during the year: one by resignation and six by change of residence. Eighteen new members were elected, making a total net membership of 143. One joint meeting was held with the Washington Academy of Sciences. Twenty-one formal scientific papers were presented and the following visiting botanists were entertained: Prof. J. C. BOSE, Dr. CAMILLO SCHNEIDER, Dr. F. KOLPIN RAVN, Dr. OTTO APPEL, and Dr. GENTARO YAMADA.

The customary reports were presented and approved and the following officers elected for the ensuing year: *President*, Prof. A. S. HITCHCOCK; *vice-president*, Dr. J. W. T. DUVEL; *recording secretary*, CHAS. E. CHAMBLISS; *corresponding secretary*, Mr. W. E. SAFFORD; *treasurer*, Dr. C. E. LEIGHTY. Dr. R. H. TRUE was nominated as the representative of the Society upon the Board of the Washington Academy of Sciences.

PERLEY SPAULDING, *Corresponding Secretary.*

[1] Coville, Frederick V. Early Botanical Activity in the District of Columbia. Records of the Columbia Historical Society, 5: 176–194. 1901.

The 107th regular meeting of the Botanical Society of Washington was held in the Assembly Hall of the Cosmos Club, at 8 p.m., Tuesday, November 2, 1915. Forty-five members and six guests were present. The following papers were presented:

Relation of catalase and oxidases to respiration in plants (with lantern): CHAS. O. APPLEMAN. (To be published in full as Bulletin No. 191 of the Maryland Agricultural Experiment Station.)

The chemical mechanism of respiration in plants is very complex and imperfectly understood. Enzyme action undoubtedly plays the most important rôle. Among the enzymes which have been assigned various functions in respiration we find the oxidases and catalase, although their relation to this process is almost entirely hypothetical. Respiration in potato tubers is not only greatly accelerated by various artificial treatments, but is subject to fluctuations under natural conditions, such as greening and sprouting. The rate of respiration also varies in different parts of the same tuber and tubers of different varieties. Since these tubers also contain very active catalase and oxidase, they were chosen as specially favorable material in making a quantitative study of the relation of both catalase and oxidase activity to the intensity of respiration. The data seem to justify the following conclusions:

1. The oxidase content in potato juice gives no indication of the intensity of respiration in the tubers. In other words, there is no correlation between oxidase activity and the rate of respiration in these organs. The author does not disclaim any rôle of the demonstrable oxidases in respiration, but they certainly are not the controlling factor in regulating the rate of respiration in potato tubers.

2. Catalase activity in the potato juice shows a very striking correlation with respiratory activity in the tubers.

Some Philippine botanical problems: E. D. MERRILL. (To be published in full elsewhere.)

Botanical notes of a trip to Japan: W. T. SWINGLE. (To be published in full elsewhere.)

The 108th regular meeting of the Society was held in the Assembly Hall of the Cosmos Club, Tuesday, December 7, 1915, at 8 p.m. Thirty-two members and three guests were present. Messrs. A. T. SPEARE, JAMES JOHNSON, H. R. ROSEN, and H. C. ROSE were elected to membership. The following papers were presented:

Dr. W. Ralph Jones: An appreciation: C. L. SHEAR.

Dr. Jones was quiet and retiring in disposition and of excellent habits. He had a great aversion to taking animal life and would not take courses in zoology involving the death of higher animals; neither would he hunt nor fish. His chief recreation and amusement were novel reading and music. He was very fond of reading good French novels in the original, and of the opera. He showed an interest in natural science early in life and as a boy began a collection of minerals and also an herbarium of flowering plants. His interests in botany were

broad and his training in languages, chemistry, and physiology were such as to give a broad and substantial foundation for research. He possessed three of the fundamental requirements for success in scientific work, namely, love for truth, combined with thoroughness and accuracy. His notes, drawings, and manuscripts were models of neatness and accuracy. He had undertaken several lines of investigation in connection with blackberry, currant, and gooseberry diseases, but had practically completed only one of these. This was a study of what appears to be a new species of *Thielavia* isolated from diseased dewberry plants. It is to be deeply regretted that a man so well equipped by temperament and training for research should be cut down in the prime of life and usefulness.

Experimental study of the life duration of seeds (with lantern): WM. CROCKER. (To be published in full elsewhere.)

Notes on variations in Chinese chestnuts (specimens): P. L. RICKER. (To be published in full elsewhere.)

The 109th regular meeting of the Society was held in the Assembly Hall of the Cosmos Club, Friday, January 14, 1916, at 8 p.m. Seventy members and five guests were present. Messrs. RODNEY B. HARVEY, G. MCMILLAN DARROW, and ROLAND MCKEE were elected to membership. The program consisted of the following papers:

Economic botanical exploration in China (with lantern): FRANK N. MEYER.

Mr. Meyer, an agricultural explorer of the United States Department of Agriculture, has spent nine years in China and adjoining countries studying the flora of this region and searching for plants of economic value for introduction into the United States. He found quite recently a hickory in China which has never been recorded in botanical literature. As yet no sycamores nor any papaw (*Asiminia triloba*) or leather-wood (*Dirca palustris*) have been found in China. Field work in botany in China is extremely difficult because most of the wild vegetation near densely settled parts has been exterminated. However Buddhist and Tavist priests have preserved many specimens in their temple compounds. Mr. Meyer made reference to the discovery of the wild peach in the provinces of Shansi, Shensi, and Kansu, and to the expertness of Chinese gardeners in grafting. He expressed the opinion that in this country there is great need of national arboreta and permanent botanical collections.

The recent outbreaks of white pine blister rust: PERLEY SPAULDING.

When this disease first reached this country, it was thought repeated annual inspections of the lots of diseased trees would soon result in the complete eradication of the disease. Experience since that time, together with increasing knowledge of the characteristics of the disease, show that this is not true. Apparently the only method of completely eradicating this disease in any lot of infected trees is that of total destruction of that lot. While large numbers of plantings of diseased imported trees were made in 1909, the careful inspection work

done since that time by the states has kept the disease in them almost completely in control. It has become increasingly evident that our great danger lies in lots of diseased trees which were imported before 1909. These in most cases we know nothing about and of course have not been able to give them the necessary inspection. In the years 1909 to 1914, inclusive, there were 11 outbreaks of this disease, that is, cases where it escaped from the diseased pines onto neighboring currents or gooseberries. In 1915 the weather conditions were so favorable for the disease that it spread very readily and for relatively long distances. Last year 12 outbreaks occurred. These areas vary in extent from only a few currant or gooseberry bushes up to a single area of some 400 or 500 square miles. Experiments have shown that the wild currants and gooseberries of the Pacific Coast and Rocky Mountain regions are susceptible to it. In fact it may be stated that all species of currants and gooseberries, so far as they have now been tested, are susceptible. The ordinary cultivated black currant, *Ribes nigrum*, however, is far more susceptible than any other species. While it is not grown in large quantities, it is very widely scattered; enough so that the disease during the past season readily spread upon this single species for miles. The future of the white pine, which has been quite largely depended upon for the forests of the northeastern states, is very seriously threatened by this disease, unless efficient efforts are made to control it. The character of this fungus is such that the removal of all wild and cultivated currants and gooseberries from the affected areas will stop its further spread in those areas. If the cultivated black currant could be eliminated from the nursery trade, so that it would not be sold and its use could gradually be discontinued everywhere within the affected states, a great step would be taken toward the control of this disease. But more than this, state officers must have absolute power to destroy diseased pines and currant and gooseberry bushes, in order that unanimous action can be carried out within these affected areas. With this power should also be given the power to declare and enforce quarantines against shipments of stock from other states. When compared with the minute search which is required in finding gypsy and brown-tail moth nests in southern New England, the search for wild and cultivated currants and gooseberries is comparatively simple. It also is comparatively easy to carry out when compared with the climbing of trees 75 to 100 feet in height in certain sections of New England for the removal of brown-tail moths' nests, as is done every year. An efficient fight against this disease even now is not impossible, but it very shortly will be if not started at once.

Catha edulis: A narcotic of the southern Arabs (with specimens): PAUL POPENOE.

The kat (Arabic *qat*) shrub is a native of Africa, but much cultivated in Yaman, where its use is increasing so that the town of Aden now consumes annually more than 2,000 camel-loads of the leaves and twigs, which are chewed for their stimulating properties. The plant contains

small quantities of an alkaloid called *katrine*, which seems to resemble cocain. It has been introduced into the United States by the Office of Foreign Seed and Plant Introduction, United States Department of Agriculture, and grows well in the South. The dangers from its use have probably been much exaggerated. This plant may present commercial possibilities as the source of a new beverage to compete with tea.

W. E. SAFFORD, *Corresponding Secretary.*

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 548th meeting of the Biological Society of Washington was held at the Cosmos Club on Saturday evening, January 15, 1916; called to order by President Hay, with 40 persons present.

The President noted the recent death of F. M. Webster, long a member of the Society.

Upon recommendation of the Council the following were elected to active membership: H. F. TAYLOR, Bureau of Fisheries, DOUGLAS C. MABBOTT, Biological Survey; WALLACE M. YATERS, Department of Agriculture.

Under the heading of Brief Notes and Exhibition of Specimens Mr. WM. PALMER exhibited a specimen of seahorse which actually came from near Colonial Beach, Chesapeake Bay, but which had attained much newspaper notoriety as having been caught in the Tidal Basin, D. C. He also exhibited the collector's sketch of a pipefish which had actually been captured in the Tidal Basin.

The regular program consisted of a communication by W. W. COOKE, *Notes on Labrador birds.* Mr. Cooke gave an interesting account of Mr. CLARENCE BIRDSEYE's experiences and travels in Labrador during the past four years while engaged in farming silver gray foxes for their fur, describing the difficulties under which he labored and the disastrous effect of the European War on the fur market. The speaker then gave an historical survey of Labrador ornithology from the early days of Cartwright to Mr. Birdseye's latest observations which include the extension of range of several species of birds. Mr. Cooke's paper was illustrated with lantern slide views of maps of Labrador, maps of migrations of certain birds, and views of several birds which had lately been observed for the first time in eastern Labrador. Mr. Birdseye's observation on Labrador birds will appear in full in the April *Auk*.

The paper was discussed by Messrs. WM. PALMER and ALEX. WETMORE.

M. W. LYON, JR., *Recording Secretary.*